

REMARKS

Claims 13-24 are pending in the application. Claim 13 has been amended to more particularly point out applicants' invention and to further distinguish applicants' invention from the prior art. In this respect, claim 13 includes the nature of the movement (set forth in claim 17) wherein the movement of the shutter element is defined as being that a 180° rotation of the electromagnetic field occurs in a stator of the stepper motor, and therefore a corresponding rotation of the motor shaft by n full steps, is carried out by the control unit.

The Examiner has rejected claims 13-24 under 35 U.S.C. § 102(b) as being anticipated by Tuchman. It is respectfully requested that these rejections be withdrawn for the following reasons.

Tuchman concerns a light modulator for oscillating operation in which the light shutter is actuated by a stepping motor. This has already been addressed in the described prior art in the present specification (see page 2, paragraph [0009]). The Tuchman approach has the following resultant technical disadvantages:

While a static operation can be realized with the arrangement described by Tuchman, the coil current cannot be reduced without increased expenditure on a corresponding control, so the power loss and therefore also the heating of the motor is relatively high. The arrangement according to Tuchman has the further disadvantage that the rotating angle only corresponds to a full step of the stepping motor. Covering an aperture of about 1 cm diameter either requires a very large full step resulting in a low torque of the stepping motor or the stepping motor must be at a correspondingly large distance from the aperture to be closed in order to realize the required switching path. The space required for such an entire assembly would increase enormously.

While the shutter described by Tuchman may be similar in construction to aspects of applicants' invention, the two approaches have very significant differences.

The most important difference is that, in Tuchman, one phase ("phase 1") of the stepping motor is supplied with current in a fixed manner (see column 3, lines 51 to 54), and a change in the current direction (see column 4, lines 1 to 5) takes place only in the other phase ("phase 2").

The movement is accordingly generated exclusively by the change in the current direction in only one phase. In contrast to the approach of the present invention, a clocking of the signal for phase 2 is required.

Accordingly, the excitation field in Tuchman is rotated only 90°, which corresponds to a half-step. In contrast, the excitation field in applicants' claimed invention is rotated by a full step, that is, 180°. The stops which are provided in Tuchman serve only to limit and, unlike applicants' approach, do not lie within the movement area, but limit only the area of a half-step (see column 3, lines 26 to 31, and column 4, lines 16 to 19).

With regard to the remaining claims presently in the case, claim 14 is allowable for the reasons set forth in claim 13.

With respect to claim 15, it is believed that the Examiner is incorrect that the stops in Tuchman serve to limit the movement area to less than n full steps.

Tuchman describes the function of the stops only as preventing exiting from the area. As was already mentioned and as can also be seen from Figure 9 in Tuchman, the field is only moved by 90°. The stops only prevent the shutter from overrunning, e.g., due to inertia. The movement would also be carried out without stops between the positions. It can be seen from the description (column 3, lines 26-32) that the stops only serve to prevent the shutter from overswinging beyond the end positions, namely, only in case the shutter moves too far. It can be gathered from this that the stops cannot lie within the movement area of n full steps.

In contrast, the stops in the claimed approach of applicants must be located before the end position because these stops of the shutter would not "know" whether it should continue 180° to the left or to the right. To ensure a defined movement of the shutter, the stops in the claimed solution of applicants are located within the movement area. Figure 3b of applicants' invention shows the position of the stop pins clearly within the 180° area.

With respect to claim 16, the passage in Tuchman that is cited by the Examiner describes a signal (monitor output) which is emitted by the control circuit 36. However, this can only be determined on the basis of the actual powering of the phases. A mechanical malfunction cannot

be determined. In the claimed invention of applicants, end position sensors are provided for this purpose and detect the actual position of the shutter. End position sensors of this kind are not provided in Tuchman.

Accordingly, the Examiner's arguments are not able to be substantiated because the signal (monitor output) of the control circuit used in Tuchman cannot accomplish the purpose of the end position sensor used in the case of the present invention.

Claim 17 addresses the method aspects of the present invention as previously discussed with respect to claim 13.

With respect to claim 18, it is believed that the Examiner is incorrect that the current direction in both windings is changed by the control unit in Tuchman.

As can be seen from the specification (column 3, lines 51 to 54), one phase (phase 1) of the stepping motor is supplied with current in a fixed manner, i.e., there is no reversal of current direction in this phase. The text cited by the Examiner (column 3, line 57, to column 4, line 5) only relates to the change in current direction in the second phase with the poles 42a and 42b. In Tuchman, the reversal of current direction is always only carried out in one phase.

With regard to claim 19, a delayed reversal of the two phases is not described in Tuchman because a reversal of the current direction is always carried out only in one phase. While the current direction remains unchanged in phase 1, the current direction is changed only in phase 2 to move the shutter. Accordingly, a time-delayed reversal of the current direction is not even possible in Tuchman.

With respect to claim 20, see the comments made above relative to claim 15.

Concerning claim 21, the text cited by the Examiner describes the movement sequence of the shutter which, as has been mentioned, is carried out only by means of alternating powering of phase 2. Further, means are described for carrying out this alternating operation, for example, with respect to noise reduction, synchronous running, etc. A reduction in current after an end point is reached is neither disclosed nor rendered obvious in any way in Tuchman. In an

alternating operation in the form of alternating powering, reducing the current also does not appear meaningful.

Relative to claim 22, Tuchman neither discloses nor renders obvious a cutoff of current. In any case, this is only possible when the self-locking torque of the arrangement is sufficiently great.

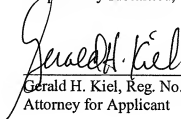
As stated above with regard to claim 21, a switching off of current also does not seem meaningful in an alternating operation in the form of an alternating powering.

With regard to claim 23, as has already been stated relative to claim 16, the text cited by the Examiner describes a signal (monitor output) which is emitted by the control circuit 36. This can only be determined based on the actual powering of the phases. A mechanical malfunction cannot be determined. End position sensors are not provided in Tuchman. Certainty about which position the shutter is actually in can only be acquired by evaluating the signals of the end position sensors.

Finally, with respect to claim 24, the text cited by the Examiner (column 3, line 57, to column 4, line 11) shows that a change in the current direction is carried out only in the second phase with the poles 42a and 42b. Applying a predetermined current direction to the windings of the stepping motor to ensure that the diaphragm opening is closed by the shutter element is not disclosed nor rendered obvious in any way by Tuchman.

Based on the above, it is submitted that all of the claims as now amended clearly and patentably distinguish over the cited art which neither teaches nor anticipates applicants' invention. It is submitted, therefore, that claims 13-24 should be allowed and that the application should promptly pass to issue.

Respectfully submitted,



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